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Sextant Observations of Comet a, 1888 (Sawerthal), made on board the ship "Alcester." By Captain Leonard C. Dart.

(*Communicated by Lieut. C. W. Baillie.*)

1888, March 22. Position at noon by Dead Reckoning: Lat. 3° 24′ S., long. 88° 32′ E.

4·30 A.M. At $10^{\mathrm{h}}\ 43^{\mathrm{m}}$ G.M.T., comet visible; distant from *Altair* 31° 17′, distant from *Arided* 56° 4′, bearing from the planet *Venus*, W.bN., distant 12° 54′. Tail W.S.W. from nucleus about 2° in length. Sky clouded up at the time of taking bearing and did not get the comet's altitude.

Ephemerides of the Satellites of Saturn, 1888–89. By A. Marth.

In the following ephemerides the five inner satellites are assumed to move in circular orbits in the plane of the ring, the ascending node N and inclination J of which, in reference to the plane of the Earth's equator, are assumed to be

for 1889·0 $N = 126°{\cdot}6663.$ $J = 6°{\cdot}9887.$

P denotes the position-angle of the minor axis of the ring, $L + 180°$ the planeocentric longitude of the Earth referred to the plane of the ring, $\Lambda + 180°$ that of the Sun, or $\Lambda - L$ the difference between the two. The last column contains the values of $\log \nu = 0{\cdot}950 - \log \Delta$, the *Naut. Alm.* values of the distances Δ of the planet from the Earth being so altered as to take the equation of light into account.

Greenwich Noon.	P	L	Latitude of above plane of Ring.		Λ−L.	Log ν.
			Earth	Sun		
1888.	°	°	°	°	°	
Oct. 19	353·030	143·253	−14·114	−16·536	−5·449	9·973631
24	·045	143·582	13·980	16·570	5·602	·977211
29	·059	143·876	13·862	16·403	5·719	·980917
Nov. 3	353·071	144·133	−13·761	−16·336	−5·799	9·984729
8	·082	·350	13·678	16·269	5·840	·988621
13	·090	·526	13·614	16·202	5·840	·992567
18	·096	·661	13·570	16·135	5·799	9·996539
23	·100	·754	13·545	16·068	5·716	0·000509
28	·102	·804	13·540	16·000	5·590	·004448
Dec. 3	353·102	144·810	−13·555	−15·933	−5·420	0·008322
8	·100	·772	13·591	15·865	5·207	·012095
13	·095	·691	13·647	15·797	4·951	·015730
18	·088	·569	13·721	15·729	4·653	·019194
23	·079	·406	13·813	15·661	4·315	·022451
28	·068	144·204	13·923	15·593	3·938	·025468

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Greenwich Noon.	P	L	Latitude of Earth above plane of Ring.	Latitude of Sun above plane of Ring.	A−L	Log ν.
1889.	°	°	°	°	°	
Jan. 2	353·056	143·966	−14·049	−15·525	−3·525	0·028210
7	·042	143·694	14·189	15·457	3·080	·030642
12	·027	143·393	14·341	15·388	2·605	·032736
17	353·011	143·067	14·503	15·320	2·105	·034468
22	352·994	142·720	14·672	15·251	1·584	·035817
27	·976	142·357	14·847	15·182	1·046	·036767
Feb. 1	352·958	141·982	−15·025	−15·113	−0·498	0·037303
6	·941	141·602	15·204	15·044	+0·055	·037417
11	·924	141·223	15·380	14·975	0·608	·037110
16	·907	140·849	15·552	14·905	1·155	·036389
21	·891	140·485	15·718	14·836	1·691	·035263
26	·876	140·138	15·874	14·766	2·211	·033747
Mar. 3	352·863	139·812	−16·019	−14·697	+2·710	0·031858
8	·850	139·511	16·151	14·627	3·183	·029620
13	·839	139·239	16·269	14·557	3·627	·027063
18	·830	139·000	16·372	14·487	4·038	·024217
23	·822	138·797	16·458	14·417	4·413	·021113
28	·816	138·633	16·527	14·347	4·750	·017784
Apr. 2	352·811	138·509	−16·578	−14·276	+5·046	0·014262
7	·808	·426	16·610	14·206	5·300	·010582
12	·807	·386	16·624	14·136	5·511	·006780
17	·807	·389	16·620	14·065	5·679	0·002890
22	·809	·435	16·597	13·994	5·804	9·998941
27	·812	·523	16·556	13·924	5·887	·994963
May 2	352·817	138·653	−16·497	−13·853	+5·928	·990984
7	·824	138·824	16·420	13·782	5·928	·987033
12	·833	139·034	16·327	13·711	5·888	·983137
17	·843	139·282	16·217	13·639	5·810	·979318
22	·855	139·566	16·091	13·568	5·696	·975595
27	352·868	139·885	−15·951	−13·496	+5·548	9·971988

The values of the apparent equatorial diameter of the ball and of the diameter of the outer rim of the ring depend on Bessel's determinations. The assumed proportion of the polar axis of the ball to the equatorial diameter is 0·900.

In the tables for the five satellites *a* and *b* denote the semi-axes of the apparent orbits, *l*−L the longitudes of the satellites in their orbits reckoned from the points which are in superior conjunction with the planet's centre or in opposition to the Earth

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in longitude. By adding to $l-\mathrm{L}$ the value of L from the preceding table, the longitudes l are found. These longitudes, which are the orbital longitudes from the ascending node added to the Right Ascension N of the ascending node, reckoned from the point of the true equinox, are corrected for the equation of light, and depend on the following assumed values, which refer to the time when the light arrives at the distance [0·950]:

Greenwich Noon.	Mimas. l_1	Enceladus. l_2	Tethys. l_3	Dione. l_4	Rhea. l_5
	°	°	°	°	°
1888, Oct. 29	296·415	308·828	261·452	283·796	43·120
Nov. 28	236·222	270·782	222·396	269·846	273·823
Dec. 28	176·031	232·736	183·341	255·896	144·526
1889, Jan. 27	115·841	194·690	144·286	241·946	15·229
Feb. 26	55·651	156·644	105·230	227·996	245·932
Mar. 28	355·462	118·598	66·174	214·046	116·635
Apr. 27	295·274	80·552	27·119	200·096	347·338
May 27	235·087	42·506	348·063	186·146	218·041

The values of P, a, b, and $l-\mathrm{L}$ are to be interpolated directly for the times for which the apparent positions of the satellites are required, and the rectangular coordinates x and y, reckoned parallel to the axis of the ring, or, if polar coordinates are wanted, the position-angles p, and distances s, of the satellites in reference to the planet's centre, are then found by means of the formulæ:

$$s \sin(p-\mathrm{P}) = x = a \sin(l-\mathrm{L}),$$
$$s \cos(p-\mathrm{P}) = y = b \cos(l-\mathrm{L}).$$

Greenwich Noon.	Diameter of Ball. Equat.	Diameter of Ball. Phase prec. l.	Diameter of Ball. Polar	Axis of Ring. Major	Axis of Ring. Minor	*Mimas.* a_1	*Mimas.* b_1	*Mimas.* $l_1-\mathrm{L}$	Diff.
1888.	″	″	″	″	″	″	″	°	°
Oct. 19	17·18	0·039	15·57	39·61	9·66	27·06	−6·60	292·00	1909·81
24	17·32	·041	15·70	39·94	9·65	27·29	6·59	41·81	·85
29	17·47	·043	15·83	40·28	9·65	27·52	6·59	151·66	·89
Nov. 3	17·63	·045	15·97	40·63	9·67	27·76	−6·60	261·55	·93
8	17·79	·046	16·11	41·00	9·70	28·01	6·62	11·48	1909·97
13	17·95	·047	16·26	41·37	9·74	28·27	6·65	121·45	1910·02
18	18·11	·046	16·41	41·75	9·80	28·53	6·69	231·47	·05
23	18·28	·045	16·56	42·14	9·87	28·79	6·74	341·52	·10
28	18·45	·044	16·71	42·52	9·96	29·05	6·80	91·62	·13
Dec. 3	18·61	·042	16·86	42·90	10·06	29·31	−6·87	201·75	·17

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Greenwich Noon.	Diameter of Ball. Equat.	Phase prec. l.	Polar	Axis of Ring. Major	Minor	*Mimas.* a_1	b_1	l_1-L	Diff.
1888.	″	″	″	″	″	″	″	°	
Dec. 8	18·77	·039	17·01	43·28	10·17	29·57	−6·95	311·92	1910 21
13	18·93	·035	17·15	43 64	10·30	29·82	7·03	62·13	·24
18	19·08	·031	17·29	43·99	10·43	30·06	7·13	172·37	·27
23	19·23	·027	17·42	44·32	10·58	30·28	7·23	282·64	·30
28	19·36	·023	17·54	44·63	10·74	30·49	7·34	32·94	·33
1889.									
Jan. 2	19·49	0·019	17·66	44·91	10·90	30·69	−7·45	143·27	1910·34
7	19·59	·014	17 76	45·16	11·07	30·86	7·56	253·61	·36
12	19·69	·010	17·85	45·38	11·24	31·01	7·68	3·97	·36
17	19·77	·007	17·92	45·56	11·41	31·13	7·80	114·33	·37
22	19·83	·004	17·98	45·71	11·58	31·23	7·91	224·70	·38
27	19·87	·002	18·02	45·81	11·74	31·30	8·02	335·08	·36
Feb. 1	19·90	foll.	18 05	45·86	11·89	31·33	−8·12	85·44	·35
6	19·90	limb	18·05	45·87	12·03	31·34	8·22	195·79	·34
11	19·89	·001	18 04	45·84	12 16	31·32	8·31	306·13	·31
16	19·85	·002	18·02	45·77	12·27	31·27	8·38	56·44	·29
21	19·80	·004	17·97	45·65	12·37	31·19	8 45	166·73	·25
26	19·73	·007	17·91	45·49	12·44	31·08	8·50	276·98	·21
Mar. 3	19·65	0·011	17·84	45·29	12·50	30·95	−8·54	27·19	·18
8	19·55	·015	17·75	45·06	12·53	30·79	8 56	137·37	·13
13	19·43	·019	17·65	44·79	12·55	30·61	8·57	247·50	·09
18	19·30	·024	17·54	44·50	12·54	30·41	8·57	357·59	1910·04
23	19·17	·028	17·41	44·18	12·52	30·19	8·55	107·63	1909·99
28	19·02	·033	17·28	43·85	12·47	29·96	8·52	217·62	·94
Apr. 2	18·87	·037	17·14	43·49	12·41	29·72	−8·48	327·56	·89
7	18·71	·040	17·00	43·13	12·33	29·47	8·42	77·45	·84
12	18·55	·043	16·85	42·75	12·23	29·21	8·36	187·29	·79
17	18·38	·045	16·70	42·37	12·12	28·95	8·28	297·08	·74
22	18·21	·047	16·55	41·99	11·99	28 69	8·19	45 82	·70
27	18·05	·048	16·40	41·60	11·85	28·42	8·10	156·52	·66
May 2	17·88	·048	16·25	41·22	11·71	28·16	−8·00	266·18	·61
7	17·72	·047	16·10	40 85	11·55	27·91	7·89	15·79	·58
12	17·56	·046	15·95	40·49	11·38	27·66	7·78	125·37	·54
17	17·41	·045	15·81	40·13	11·21	27·42	7·66	234·91	·51
22	17·26	·043	15·67	39 79	11·03	27·18	7·53	344·42	1909·48
27	17·12	0·040	15·54	39·46	10·84	26·96	−7·41	93·90	

Greenwich Noon.		*Enceladus.*				*Tethys.*			
		a_2	b_2	$l_2-\mathrm{L}$	Diff.	a_3	b_3	$l_3-\mathrm{L}$	Diff
1888.		″	″	°	°	″	″	°	°
Oct.	19	34·72	− 8·47	57·41	1313·46	42·98	−10·48	10·59	953·2
	24	35·00	8·46	290·87	·48	43·33	10·47	243·85	·2
	29	35·30	8·46	164·35	·52	43·70	10·47	117·14	·3
Nov.	3	35·62	− 8·47	37·87	·57	44·09	−10·49	350·46	·3
	8	35·94	8·50	271·44	·61	44·49	10·52	223·82	·4
	13	36·26	8·54	145·05	·65	44·89	10·57	97·22	·4
	18	36·60	8·59	18·70	·69	45·30	10·63	330·67	·4
	23	36·93	8·65	252·39	·73	45·72	10·71	204·16	·5
	28	37·27	8·73	126·12	·77	46·14	10·80	77·69	·5
Dec.	3	37·60	− 8·81	359·89	·81	46·55	−10·91	311·26	·6
	8	37·93	8·91	233·70	·85	46·96	11·03	184·87	·6
	13	38·25	9·02	107·55	·88	47·35	11·17	58·52	·6
	18	38·56	9·15	341·43	·92	47·73	11·32	292·21	·7
	23	38·85	9·28	215·35	·95	48·09	11·48	165·94	·7
	28	39·12	9·41	89·30	1313·98	48·42	11·65	39·70	·7
1889.									
Jan.	2	39·37	− 9·56	323·28	1314·00	48·73	−11·83	273·49	953·8
	7	39·59	9·70	197·28	·02	49·00	12·01	147·30	·8
	12	39·78	9·85	71·30	·03	49·24	12·20	21·13	·8
	17	39·94	10·00	305·33	·05	49·44	12·38	254·98	·8
	22	40·06	10·15	179·38	·05	49·59	12·56	128·85	·8
	27	40·15	10·29	53·43	·05	49·70	12·73	2·72	·8
Feb.	1	40·20	−10·42	287·48	·04	49·76	−12·90	236·60	·8
	6	40·21	10·55	161·52	·03	49·77	13·05	110·47	·8
	11	40·18	10·66	35·55	1314·01	49·74	13·19	344·34	·8
	16	40·11	10·76	269·56	1313·99	49·66	13·31	218·19	·8
	21	40·01	10·84	143·55	·96	49·53	13·42	92·02	·8
	26	39·87	10·90	17·51	·93	49·36	13·50	325·82	·7
Mar.	3	39·70	−10·95	251·44	·90	49·14	−13·56	199·60	·7
	8	39·49	10·99	125·34	·86	48·89	13·60	73·35	·7
	13	39·26	11·00	359·20	·81	48·60	13·62	307·06	·6
	18	39·01	10·99	233·01	·77	48·28	13·61	180·72	·6
	23	38·73	10·97	106·78	·73	47·94	13·58	54·35	·5
	28	38·43	10·93	340·51	·67	47·57	13·53	287·93	·5
Apr.	2	38·12	−10·88	214·18	·63	47·19	−13·46	161·47	·4
	7	37·80	10·81	87·81	·58	46·79	13·38	34·96	·4
	12	37·47	10·72	321·39	1313·54	46·38	13·27	268·41	953·4

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Greenwich Noon.		*Enceladus.* a_2	b_2	l_2−L	Diff.	*Tethys.* a_3	b_3	l_2−L	Diff.
1889.		″	′	°	°	″	″	c	°
Apr.	17	37·14	−10·62	194·93	1313·49	45·97	−13·15	141·81	953·36
	22	36·80	10·51	68·42	·45	45·55	13·01	15·17	·31
	27	36·46	10·39	301·87	·41	45·14	12·86	248·48	·27
May	2	36·13	−10·26	175·28	·36	44·73	−12·70	121·75	·23
	7	35·81	10·12	48·64	·32	44·32	12·53	354·98	·19
	12	35·49	9·98	281·96	·28	43·93	12·35	228·17	·15
	17	35·17	9·82	155·24	·25	43·54	12·16	101·32	·12
	22	34·87	9·67	28·49	1313·23	43·17	11·97	334·44	953·09
	27	34·59	− 9·50	261·72		42·81	−11·77	207·53	

Greenwich Noon.		*Dione.* a_4	b_4	l_4−L	Diff.	*Rhea.* a_5	b_5	l_5−L	Diff.
1883.		″	″	°	°	″	″	°	°
Oct.	19	55·04	−13·42	264·77	657·41	76·86	−18·74	182·71	398·16
	24	55·50	13·41	202·18	·44	77·50	18·72	220·87	·19
	29	55·97	13·41	139·62	·48	78·17	18·73	259·06	·23
Nov.	3	56·47	−13·43	77·10	·52	78·86	−18·76	297·29	·27
	8	56·97	13·47	14·62	·56	79·57	18·81	335·56	·31
	13	57·49	13·53	312·18	·60	80·29	18·90	13·87	·36
	18	58·02	13·61	249·78	·64	81·03	19·01	52·23	·39
	23	58·56	13·71	187·42	·69	81·77	19·15	90·62	·44
	28	59·09	13·83	125·11	·73	82·52	19·32	129·06	·48
Dec.	3	59·62	−13·97	62·84	·77	83·26	−19·51	167·54	·52
	8	60·14	14·13	0·61	·81	83·98	19·74	206·06	·57
	13	60·64	14·31	298·42	·85	84·69	19·98	244·63	·60
	18	61·13	14·50	236·27	·89	85·37	20·25	283·23	·65
	23	61·59	14·71	174·16	·92	86·01	20·54	321·88	·68
	28	62·02	14·92	112·08	·95	86·61	20·84	0·56	·71
1889.									
Jan.	2	62·41	−15·15	50·03	657·98	87·16	−21·16	39·27	398·74
	7	62·76	15·38	348·01	658·01	87·65	21·48	78·01	·77
	12	63·07	15·62	286·02	·03	88·07	21·81	116·78	·79
	17	63·32	15·86	224·05	·04	88·42	22·14	155·57	·81
	22	63·52	16·09	162·09	·05	88·70	22·47	194·38	·82
	27	63·65	16·31	100·14	·05	88·89	22·78	233·20	·83
Feb.	1	63·73	−16·52	38·19	·06	89·00	−23·07	272·03	·83
	6	63·75	16·72	336·25	·05	89·02	23·35	310·86	·83
	11	63·70	16·90	274·30	·04	88·96	23·60	349·69	·82
	16	63·60	17·05	212·34	658·02	88·82	23·81	28·51	398·80

Greenwich Noon. 1889.		Dione. a_4	Dione. b_4	Dione. l_4-L	Dione. Diff.	Rhea. a_5	Rhea. b_5	Rhea. l_5-L	Rhea. Diff.
		″	″	°	°	″	″	°	°
Feb.	21	63·43	−17·18	150·36	658·00	88·59	−24·00	67·31	398·79
	26	63·21	17·29	88·36	657·98	88·28	24·14	106·10	·76
Mar.	3	62·94	−17·37	26·34	·94	87·89	−24·25	144·86	·73
	8	62·62	17·42	324·28	·91	87·44	24·32	183·59	·70
	13	62·25	17·44	262·19	·87	86·93	24·35	222·29	·67
	18	61·84	17·43	200·06	·83	86·36	24·34	260·96	·63
	23	61·40	17·40	137·89	·79	85·75	24·29	299·59	·58
	28	60·93	17·33	75·68	·75	85·09	24·21	338·17	·54
Apr.	2	60·44	−17·24	13·43	·70	84·40	−24·08	16·71	·50
	7	59·93	17·13	311·13	·66	83·69	23·92	55·21	·45
	12	59·41	17·00	248·79	·61	82·96	23·74	93·66	·41
	17	58·88	16·84	186·40	·57	82·22	23·52	132·07	·37
	22	58·34	16·67	123·97	·52	81·48	23·27	170·44	·33
	27	57·84	16·47	61·49	·49	80·74	23·01	208·77	·28
May	2	57·29	−16·27	258·98	·44	80·00	−22·72	247·05	·24
	7	56·77	16·05	296·42	·40	79·28	22·41	285·29	·20
	12	56·26	15·82	233·82	·36	78·57	22·09	323·49	·16
	17	55·77	15·57	171·18	·33	77·88	21·75	1·65	·13
	22	55·29	15·32	108·51	657·30	77·21	21·40	39·78	398·10
	27	54·83	−15·07	45·81		76·57	−21·04	77·88	

Approximate Differences of Right Ascension and Declination between the three outer Satellites and the Centre of Saturn.

Greenwich Noon. 1888.		Titan. α_6-A	Titan. δ_6-D	Hyperion. α_7-A	Hyperion. δ_7-D	Iapetus. α_8-A	Iapetus. δ_8-D
		s	″	s	″	s	″
Oct.	19	− 9·63	−43·7	...	...	+36·53	+1·5
	20	6·02	48·3	...	...	36·60	2·4
	21	− 1·55	−46·2	...	...	+36·49	+3·4
	22	+ 3·15	37·5	...	...	36·20	4·4
	23	+ 7·40	−23·2	...	...	+35·70	+5·5
	24	10·54	− 5·5	...	...	34·98	6·5
	25	+12·04	+13·1	...	...	+34·05	+7·4
	26	11·60	29·6	...	...	32·91	8·3
	27	+ 9·25	+41·2	...	...	+31·57	+9·1
	28	5·35	45·9	...	...	30·03	9·9
	29	+ 0·54	+43·0	+12·58	+36·3	+28·30	+10·7
	30	− 4·37	33·1	9·84	46·4	26·39	11·3

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Greenwich Noon. 1888.		*Titan.*		*Hyperion.*		*Iapetus.*	
		α_6-A	δ_6-D	α_7-A	δ_7-D	α_8-A	δ_8-D
		s	″	s	″	s	″
Oct.	31	− 8·61	+18·0	+ 5·88	+50·6	+24·32	+11·9
Nov.	1	11·55	0·0	+ 1·15	48·6	22·08	12·5
	2	−12·79	−18·0	− 3·73	+40·9	+19·69	+12·9
	3	12·18	33·4	8·23	28·6	17·17	13·3
	4	− 9·85	−44·1	−11·93	+13·4	+14·53	+13·6
	5	6·13	48·7	14·60	− 2·9	11·78	13·9
	6	− 1·53	−46·3	−16·10	−19·1	+ 8·95	+14·1
	7	+ 3·30	37·3	16·43	33·9	6·05	14·2
	8	+ 7·67	−22·8	−15·64	−46·5	+ 3·09	+14·2
	9	10·88	− 4·8	13·85	56·1	+ 0·10	14·2
	10	+12·38	+13·9	−11·18	−62·2	− 2·89	+14·1
	11	11·89	30·5	7·81	64·4	5·88	13·9
	12	+ 9·43	+42·0	− 3·94	−62·7	− 8·85	+13·6
	13	5·33	46·5	+ 0·20	56·8	11·76	13·3
	14	+ 0·43	+43·3	+ 4·33	−47·1	−14·61	+12·9
	15	− 4·62	33·1	8·16	33·9	17·37	12·4
	16	− 8·96	+17·5	+11·34	−18·0	−20·02	+11·9
	17	11·94	− 0·7	13·52	− 0·4	22·55	11·3
	18	−13·16	−19·0	+14·35	+17·3	−24·94	+10·6
	19	12·49	34·5	13·60	33·1	27·16	9·9
	20	−10·04	−45·2	+11·25	+44·9	−29·21	+ 9·1
	21	6·17	49·6	7·46	51·2	31·07	8·2
	22	− 1·41	−47·0	+ 2·73	+51·1	−32·73	+ 7·3
	23	+ 3·57	37·5	− 2·35	44·8	34·18	6·3
	24	+ 8·03	−22·5	− 7·20	+33·5	−35·40	+ 5·3
	25	11·29	− 4·1	11·34	18·7	36·39	4·3
	26	+12·77	+15·1	−14·46	+ 2·1	−37·14	+ 3·2
	27	12·17	31·9	16·41	−14·7	37·65	2·1
	28	+ 9·56	+43·4	−17·13	−30·5	−37·91	+ 1·0
	29	5·33	47·7	16·67	44·2	37·92	− 0·1
	30	+ 0·20	+44·1	−15·11	−55·1	−37·68	− 1·3
Dec.	1	− 4·98	33·3	12·60	62·6	37·20	2·4
	2	− 9·40	+17·1	− 9·30	−66·3	−36·47	− 3·6
	3	12·40	− 1·7	5·40	65·8	35·50	4·8
	4	−13·56	−20·4	− 1·14	−61·0	−34·31	− 5·9
	5	12·77	36·2	+ 3·21	52·2	32·89	7·0
	6	−10·16	−47·0	+ 7·34	−39·5	31·25	− 8·1

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Greenwich Noon. 1888.	*Titan.* α_6-A	*Titan.* δ_6-D	*Hyperion.* α_7-A	*Hyperion.* δ_7-D	*Iapetus.* α_8-A	*Iapetus.* δ_8-D
	s	″	s	″	s	″
Dec. 7	− 6·10	−51·2	+10·90	−23·6	−29·41	− 9·2
8	− 1·17	−48·1	+13·51	− 5·7	−27·38	−10·2
9	+ 3·95	38·1	14·80	+12·9	25·18	11·2
10	+ 8·50	−22·3	+14·50	+30·2	−22·81	−12·1
11	11·76	− 3·1	12·48	43·9	20·29	12·9
12	+13·16	+16·6	+ 8·91	+52·3	−17·63	−13·7
13	12·41	33·8	+ 4·20	54·1	14·85	14·4
14	+ 9·60	+45·4	− 1·05	+49·3	−11·98	−15·1
15	+ 5·17	49·4	6·20	38·8	9·02	15·6
16	− 0·14	+45·3	−10·73	+24·2	− 6·00	−16·1
17	5·45	33·7	14·28	+ 7·2	− 2·93	16·5
18	− 9·92	+16·7	−16·63	−10·5	+ 0·16	−16·7
19	12·88	− 2·9	17·71	27·4	3·27	16·9
20	−13·94	−22·3	−17·55	−42·6	+ 6·37	−16·9
21	12·98	38·5	16·21	55·0	9·45	16·9
22	−10·17	−49·3	−13·84	−64·0	+12·48	−16·7
23	5·91	53·2	10·59	69·0	15·44	16·4
24	− 0·80	−49·6	− 6·67	−69·8	+18·32	−16·0
25	+ 4·45	38·8	− 2·31	66·1	21·11	15·5
26	+ 9·04	−22·1	+ 2·22	−57·9	+23·78	−14·8
27	12·25	− 2·0	6·59	45·6	26·32	14·1
28	+13·51	+18·6	+10·46	−29·7	+28·71	−13·2
29	12·57	36·2	13·43	−11·1	30·94	12·2
30	+ 9·52	+47·8	+15·13	+ 8·5	+32·99	−11·1
31	+ 4·87	51·5	15·21	27·4	34·85	9·9
32	− 0·61	+46·7	+13·53	+43·2	+36·51	− 8·6

Approximate Greenwich times of conjunctions of the satellites with the centre of the planet or of their passages in the direction of the minor axis of the ring.

"n" inferior conjunction, or satellite north, moving from the following to the preceding side.

"s" superior conjunction, or satellite south, moving from the preceding to the following side.

In the case of *Titan* and *Iapetus* the approximate distances from the major axis of the ring are added, at which they pass in the direction of the minor axis. In the case of *Iapetus* and of the fixed star of Dec. 12, the conjunctions with the ends of the ring ("f" following, "p" preceding end) are also given.

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1888.		h	
Oct.	21	9·7	Tit. s. 44″
	29	4·2	Tit. n. 42″
		7·4	Di. n.
		7·9	Te. n.
		17·9	En. s.
	30	6·4	Rh. s.
		6·6	Te. s.
		10·3	En. n.
		16·2	Di. s.
	31	5·2	Te. n.
		19·2	En. n.
Nov.	1	1·1	Di. n.
		3·9	Te. s.
		11·6	En. s.
		12·6	Rh. n.
	2	2·5	Te. n.
		9·9	Di. s.
		18·9	Mi. n.
		20·5	En. s.
	3	1·2	Te. s.
		13·0	En. n.
		17·5	Mi. n.
		18·8	Di. n.
		18·9	Rh. s.
		23·9	Te. n.
	4	16·1	Mi. n.
		21·9	En. n.
		22·5	Te. s.
	5	3·6	Di. s.
		14·3	En. s.
		14·7	Mi. n.
		21·2	Te. n.
	6	1·1	Rh. n.
		9·4	Tit. s. 44″
		12·5	Di. n.
		13·3	Mi. n.
		19·8	Te. s.
	7	12·0	Mi. n.
		15·6	En. n.
		18·5	Te. n.
		21·3	Di. s.
	8	7·4	Rh. s.
		8·1	En. s.
		10·6	Mi. n.
		14·3	Iap. fn. 12″
		17·1	Te. s.
		21·9	Mi. s.
	9	0·5	En. n.
		1·8	Iap. n. 14″
		6·2	Di. n.
		8·3	Di. ☌ Iap.
		13·3	Iap. pn. 17″
		15·8	Te. n.
		17·0	En. s.
		20·5	Mi. s.
	10	9·4	En. n.
		13·6	Rh. n.
		14·4	Te. s.
		15·0	Di. s.
Nov.	10	19·1	Mi. s.
	11	1·9	En. s.
		13·1	Te. n.
		17·7	Mi. s.
		18·3	En. n.
		23·9	Di. n.
	12	10·7	En. s.
		11·8	Te. s.
		16·4	Mi. s.
		19·8	Rh. s.
	13	8·7	Di. s.
		10·4	Te. n.
		15·0	Mi. s.
		19·6	En. s.
	14	3·6	Tit. n. 42″
		9·1	Te. s.
		12·1	En. n.
		13·6	Mi. s.
		17·6	Di. n.
	15	2·0	Rh. n.
		4·5	En. s.
		7·7	Te. n.
		12·2	Mi. s.
		21·0	En. n.
	16	2·4	Di. s.
		6·4	Te. s.
		10·8	Mi. s.
		13·4	En. s.
		22·1	Mi. n.
	17	5·0	Te. n.
		8·3	Rh. s.
		11·3	Di. n.
		20·8	Mi. n.
		22·3	En. s.
	18	3·7	Te. s.
		14·7	En. n.
		19·4	Mi. n.
		20·1	Di. s.
	19	2·3	Te. n.
		14·5	Rh. n.
		18·0	Mi. n.
		23·6	En. n.
	20	1·0	Te. s.
		4·9	Di. n.
		16·1	En. s.
		16·6	Mi. n.
		23·6	Te. n.
	21	8·5	En. n.
		13·8	Di. s.
		15·2	Mi. n.
		20·7	Rh. s.
		22·3	Te. s.
	22	0·9	En. s.
		8·5	Tit. s. 45″
		13·8	Mi. n.
		17·4	En. n.
		21·0	Te. n.
		22·6	Di. n.
	23	9·8	En. s.
Nov.	23	12·5	Mi. n.
		19·6	Te. s.
	24	2·9	Rh. n.
		7·5	Di. s.
		18·3	Te. n.
		18·7	En. s.
	25	16·3	Di. n.
		16·9	Te. s.
	26	9·1	Rh. s.
		15·6	Te. n.
		20·0	En. n.
	27	1·2	Di. s.
		12·5	En. s.
		14·2	Te. s.
		18·2	Mi. s.
	28	10·0	Di. n.
		12·9	Te. n.
		15·3	Rh. n.
		16·9	Mi. s.
		21·4	En. s.
	29	11·5	Te. s.
		13·8	En. n.
		15·5	Mi. s.
		18·8	Di. s.
	30	2·6	Tit. n. 43″
		10·2	Te. n.
		14·1	Mi. s.
		21·5	Rh. s.
		22·7	En. n.
Dec.	1	3·7	Di. n.
		8·8	Te. s.
		12·7	Mi. s.
		15·1	En. s.
	2	7·5	Te. n.
		7·6	En. n.
		11·3	Mi. s.
		12·5	Di. s.
		22·6	Mi. n.
	3	0·0	En. s.
		3·7	Rh. n.
		6·1	Te. s.
		16·4	En. n.
		21·2	Mi. n.
		21·4	Di. n.
	4	4·8	Te. n.
		8·9	En. s.
		19·9	Mi. n.
	5	3·4	Te. s.
		6·2	Di. s.
		9·9	Rh. s.
		17·8	En. s.
		18·5	Mi. n.
	6	2·1	Te. n.
		10·2	En. n.
		15·0	Di. n.
		17·1	Mi. n.
	7	0·7	Te. s.
		15·7	Mi. n.
		16·1	Rh. n.

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1888.	h	
Dec. 7	19·1	En. n.
	23·4	Te. n.
	23·9	Di. s.
8	7·2	Tit. s. 46″
	11·5	En. s.
	14·3	Mi. n.
	22·0	Te. s.
9	8·7	Di. n.
	12·9	Mi. n.
	20·4	En. s.
	20·7	Te. n.
	22·3	Rh. s.
10	11·6	Mi. n.
	12·9	En. n.
	17·6	Di. s.
	19·3	Te. s.
	22·9	Mi. s.
11	18·0	Te. n.
	21·5	Mi. s.
	21·7	En. n.
12	2·3	✱ 9^{m}pn59″†
	2·4	Di. n.
	4·5	Rh. n.
	10·1	✱ 9^{m}n.44″†
	14·2	En. s.
	16·6	Te. s.
	17·7	✱ 9^{m}fn30″†
	20·1	Mi. s.
13	11·2	Di. s.
	15·3	Te. n.
	18·7	Mi. s.
	23·1	En. s.
14	10·7	Rh. s.
	13·9	Te. s.
	15·5	En. n.
	17·3	Mi. s.
	20·1	Di. n.
15	7·9	En. s.
	12·6	Te. n.
	15·9	Mi. s.
Dec. 16	0·4	En. n.
	1·1	Tit. n. 45″
	4·9	Di. s.
	11·2	Te. s.
	14·6	Mi. s.
	16·8	En. s.
	16·9	Rh. n.
17	9·3	En. n.
	9·9	Te. n.
	12·0	Iap. ps. 14″
	13·2	Mi. s.
	13·7	Di. n.
18	0·0	Iap. s. 17″
	1·7	En. s.
	8·5	Te. s.
	11·7	Iap. fs. 20″
	11·8	Mi. s.
	18·1	En. n.
	22·6	Di. s.
	23·1	Mi. n.
	23·1	Rh. s.
19	7·2	Te. n.
	10·3	Mi. s.
	10·6	En. s.
	21·7	Mi. n.
20	3·0	En. n.
	5·8	Te. s.
	7·4	Di. n.
	19·5	En. s.
	20·3	Mi. n.
21	4·5	Te. n.
	5·3	Rh. n.
	16·2	Di. s.
22	3·1	Te. s.
23	1·1	Di. n.
	1·8	Te. n.
	11·5	Rh. s.
	13·2	En. s.
	16·2	Mi. n.
24	0·4	Te. s.
Dec. 24	5·6	Tit. s. 47″
	5·6	En. n.
	9·9	Di. n.
	14·8	Mi. n.
	22·1	En. s.
	23·1	Te. n.
25	13·4	Mi. n.
	14·5	En. n.
	17·6	Rh. n.
	18·7	Di. n.
	21·7	Te. s.
26	7·0	En. s.
	12·0	Mi. n.
	20·4	Te. n.
	23·3	Mi. s.
	23·4	En. n.
27	3·5	Di. s.
	10·6	Mi. n.
	15·8	En. s.
	19·0	Te. s.
	21·9	Mi. s.
	23·8	Rh. s.
28	8·3	En. n.
	12·4	Di. n.
	17·6	Te. n.
	20·5	Mi. s.
29	16·3	Te. s.
	17·2	En. n.
	19·2	Mi. s.
	21·2	Di. s.
30	6·0	Rh. n.
	9·6	En. s.
	14·9	Te. n.
	17·8	Mi. s.
31	6·0	Di. n.
	13·6	Te. s.
	16·4	Mi. s.
	18·5	En. s.
	23·1	Tit. n. 47″

By means of this list of conjunctions (the continuation of which, together with the continuation of the predicted places of the three outer satellites, will be published in the next number of the *Monthly Notices*) approximate values of the coordinates x and y of the five inner satellites may be easily found for any other time t with the help of the following little table, the argument of which is the interval τ between the time t and the time of the next preceding or following conjunction, the coordinates x and y being expressed in semi-diameters of the planet's equator. The satellites are on the same side, north or south, of the major axis

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† The star is W. B. 9^{h}·638, and its assumed apparent place α 9^{h} 31^{m} 48^{s}·11, δ + 15° 43′ 2″·6.

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of the ring as at the time of the next conjunction, and, as they move in the direction of *de*creasing position-angles, they are in the interval between a north and a south conjunction on the preceding side, and between a south and a north conjunction on the following side of the direction of the minor axis of the ring. They are at their greatest elongations, Mi. 5·7, En. 8·2, Te. 11·3, Di. 16·4, Rh. 27·1 hours before or after the times of conjunction.

τ	*Mimas.*		*Enceladus.*		*Tethys.*		*Dione.*		*Rhea.*	
h	x_1	y_1	x_2	y_2	x_3	y_3	x_4	y_4	x_5	y_5
0	0·0	0·8	0·0	1·0	0·0	1·2	0·0	1·6	0·0	2·2
1	0·9	0·8	0·8	1·0	0·7	1·2	0·6	1·6	0·5	2·2
2	1·7	0·7	1·5	0·9	1·4	1·2	1·2	1·6	1·0	2·2
3	2·3	0·5	2·2	0·8	2·0	1·1	1·8	1·5	1·5	2·2
4	2·8	0·3	2·8	0·7	2·6	1·1	2·4	1·5	2·0	2·2
5	3·1	0·1	3·3	0·6	3·2	1·0	2·9	1·4	2·5	2·1
6	3·1	0·1	3·7	0·4	3·7	0·8	3·5	1·3	3·0	2·1
7	2·9	0·3	3·9	0·2	4·1	0·7	4·0	1·3	3·5	2·1
8	2·5	0·5	4·0	0·0	4·5	0·6	4·4	1·2	4·0	2·0
9	1·8	0·6	4·0	0·1	4·7	0·4	4·8	1·0	4·5	1·9
10	1·1	0·7	3·8	0·3	4·9	0·2	5·2	0·9	4·9	1·9
11					5·0	0·1	5·6	0·8	5·3	1·8
12							5·8	0·7	5·7	1·7
14							6·2	0·5	6·5	1·6
16							6·4	0·1	7·1	1·4
20									8·2	0·9
27·1									8·9	0·0

Observers who are desirous to follow the motions of the satellites will find it of service to lay down the data of the table graphically on a sufficiently large scale, so that, by marking the corresponding times for the night of observing, they may get information about the places of the satellites at a glance.

Careful observations of the position-angles of the satellites at the times of their passing in the direction of the minor axis of the ring afford the best means for determining their orbital longitudes, and will be especially valuable while the apparent orbits are closing in, before they are intercepted by the body of the planet.

The present and the next apparition of *Saturn* are the most favourable for observing the differences of right ascension and declination between *Iapetus* and the centre of *Saturn*, and procuring thereby the best direct data for fixing the elements of

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the satellite's orbit. The opportunities for observing the conjunctions of the satellite with the centre of the planet (when it may be preferable to observe position-angles and distances) should not be missed, especially those of the closer conjunctions, Nov. 8–9, and Dec. 17–18.

Ephemeris of the Satellite of Neptune, 1888–89. By A. Marth.

Greenwich Noon.	P′	*a*	*b*	*u*−U	Diff.	U	B
1888.	°	″	″	°	°	°	°
Oct. 19	324·79	16·87	8·52	264·32	612·35	129·20	−30·30
29	324·58	16·92	8·52	156·67	·31	129·45	30·21
Nov. 8	324·36	16·96	8·51	48·98	·28	129·73	30·11
18	324·12	16·97	8·48	301·26	·27	130·02	30·00
28	323·88	16·97	8·45	193·53	·27	130·32	29·88
Dec. 8	323·64	16·95	8·41	85·80	·28	130·61	29·76
18	323·42	16·91	8·37	338·08	·29	130·88	29·65
28	323·23	16·86	8·31	230·37	·33	131·11	29·55
1889.							
Jan. 7	323·07	16·79	8·26	122·70	612·37	131·31	−29·47
17	322·95	16·71	8·20	15·07	·42	131·46	29·40
27	322·87	16·62	8·14	267·49	·48	131·55	29·35
Feb. 6	322·84	16·53	8·09	159·97	·53	131·59	29·32
16	322·86	16·43	8·05	52·50	·59	131·56	29·32
26	322·92	16·34	8·01	305·09	·65	131·48	29·34
Mar. 8	323·03	16·25	7·97	197·74	·71	131·34	29·39
18	323·19	16·16	7·95	90·45	612·76	131·14	29·36
28	323·39	16·09	7·93	243·21		130·89	29·55

P′ position-angle of the minor axis of the satellite's apparent orbit, in the direction of superior conjunction.

a, *b*, major and minor semi-axes of the apparent orbit.

u−U, longitude of the satellite in its orbit, reckoned from the point which is in superior conjunction with the planet or in opposition to the earth.

U + 180°, planetocentric longitude of the earth, reckoned in the satellite's orbit from the ascending node on the celestial equator.

B, planetocentric latitude of the earth above the plane of the orbit.

The values of $u-\mathrm{U}$, P′, a, b are to be interpolated directly for the times for which the apparent positions of the satellite are required, and the position-angles p and distances s of the satellite are then found by means of the formulæ

$$s \sin(\mathrm{P}'-p) = a \sin(u-\mathrm{U})$$
$$s \cos(\mathrm{P}'-p) = b \cos(u-\mathrm{U}).$$